GUJARAT TECHNOLOGICAL UNIVERSITY

MECHATRONICS (47)
DYNAMICS OF MACHINES
SUBJECT CODE: 2734703
M.E. 3rd SEMESTER

Type of course: Engineering Science

Prerequisite: - NA

Rationale: This subject deals with fundamentals of mechanical vibrations which are useful to analyze mechatronics systems.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
				Theory Marks		Practical Marks				
L	T	P	C	ESE (E)	PA (M)	ESE (V)		PA (I)		
						ESE	OEP	PA	RP	
3	2#	2	5	70	30	20	10	10	10	150

Content:

Sr. No.	Content	Hours	% Weightage
1.	**Fundamentals of mechanical vibrations:** Sources of vibration, Free Vibration, Forced vibration, Simple harmonic motion, Campbell diagram, Fourier analysis	03	6%
2.	**Single degree of freedom system-Free Vibrations:** Natural frequency, Equivalent system, Energy method, Response to an initial disturbance, Phase plane method, Duhamel's integral, Stiffness modeling, Non linear stiffness	05	11%
3.	**Single degree of freedom system-Damped vibrations:** Damped models, single degree of freedom system with viscous damping, Logarithmic decrement, General excitation- Duhamel's integral	05	12%
4.	**Single degree of freedom system-Forced Vibrations:** Harmonic excitation, Mechanical Impedance, System identification from frequency response	05	12%
5.	**Two Degree of Freedom Systems:** Free vibration of spring coupled system, Two degrees of freedom mass coupled systems, Forced vibrations of undamped system, Undamped vibration absorbers, Forced damped vibrations, Vibration Isolation	05	12%
6.	**Multi degree of freedom systems:** Closed couple systems, Far coupled systems, Orthogonality of mode shapes, Modal analysis, Forced vibration, Using Lagrange's equation to derive equation of motion	08	19%
7.	**Numerical methods:** Approximate methods for fundamental frequency, Dunkerley's lower bound approximation, Rayleigh's upper bound approximation, Matrix method	06	14%

8.	**Continuous systems:** System governed by wave equation, solution of wave equation for free and forced vibrations, Free and forced vibration of beams	06	14%

Reference Books:

1. Theory and Practice of Mechanical Vibrations J. S. Rao, K. Gupta, New Age International Publishers
2. Mechanical Vibrations S. S. Rao, Pearson Education
3. Mechanical Vibrations S. G. Kelly, McGraw-Hill International editions
4. Engineering Vibration D. J. Inman, Prentice Hall

Course Outcome:

CO1: Students will able to understand importance of mechanical vibrations in design of mechatronics systems.
CO2: Students will able to understand free vibrations, damped vibrations and forced vibrations of single degree of freedom systems and multi degree of freedom systems.
CO3: Students will able to determine exact and approximate natural frequency of mechanical systems.

List of Experiments:

1. Experiments based on single degree of freedom systems;
2. Experiments based on two degree of freedom systems.
3. Experiments on lateral vibration of beams.
4. Draw the Campbell diagram using computer software (like MATLAB, Labview, Scilab).
5. Modal analysis using computer software (like MATLAB, Labview, Scilab).

Design based Problems (DP)/Open Ended Problem:
Students may be given a task to exhibit the knowledge of the course studied during the academic year.

Major Equipments:

Equivalent Mechanisms may be used for the performance of practical.

List of Open Source Software/learning website:

Scilab software

Review Presentation (RP): The concerned faculty member shall provide the list of peer reviewed Journals and Tier-I and Tier-II Conferences relating to the subject (or relating to the area of thesis for seminar) to the students in the beginning of the semester. The same list will be uploaded on GTU website during the first two weeks of the start of the semester. Every student or a group of students shall critically study 2 papers, integrate the details and make presentation in the last two weeks of the semester. The GTU marks entry portal will allow entry of marks only after uploading of the best 3 presentations. A unique id number will be generated only after uploading the presentations. Thereafter the entry of marks will be allowed. The best 3 presentations of each college will be uploaded on GTU website.